DOTOET "h2h22260

Fig. 1a

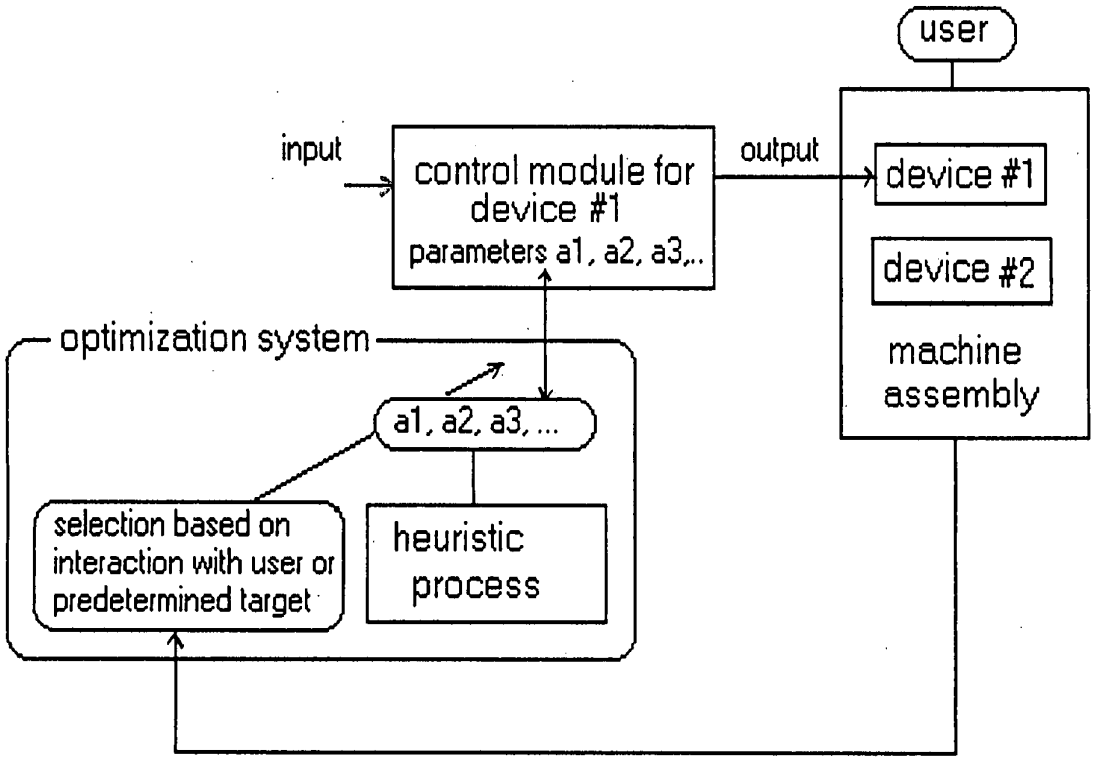


Fig. 1b

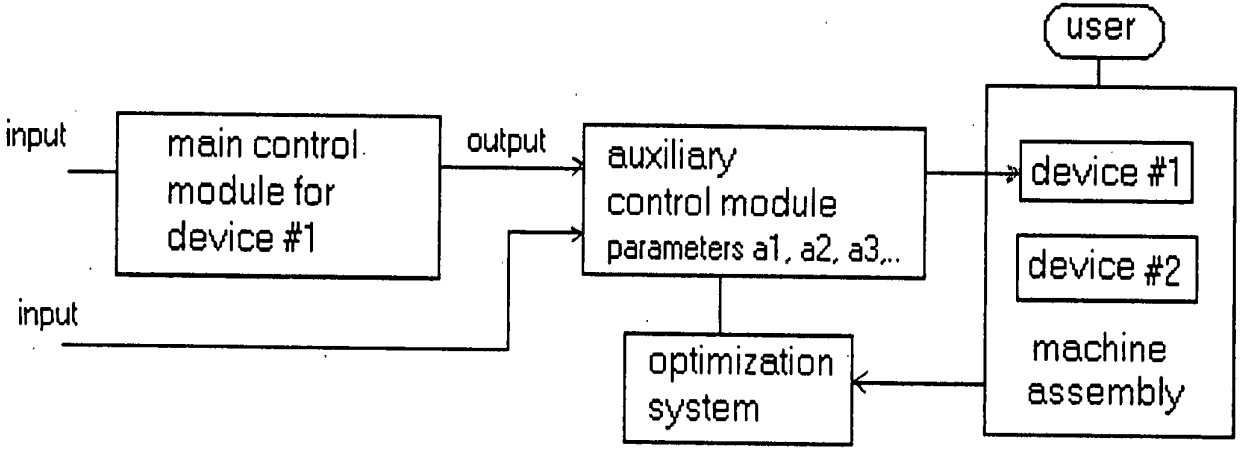

user
input
main control module for device #1
output
auxiliary control module
parameters a1, a2, a3,..
device #1
device #2
machine assembly
input
optimization system

Fig. 1c

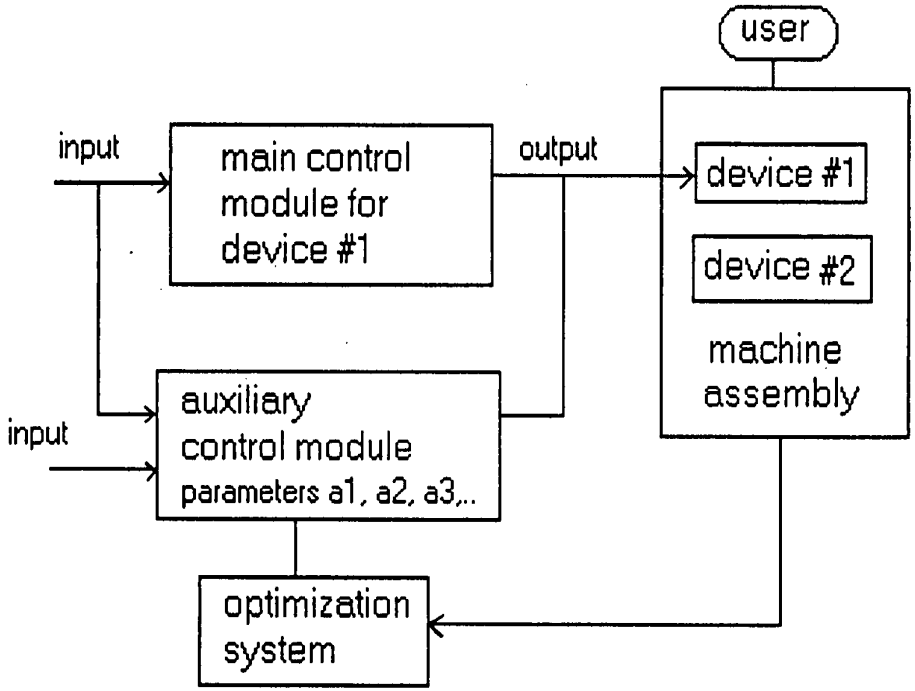

user
input
main control module for device #1
output
device #1
device #2
machine assembly
input
auxiliary control module
parameters a1, a2, a3,..
optimization system

Fig. 1d

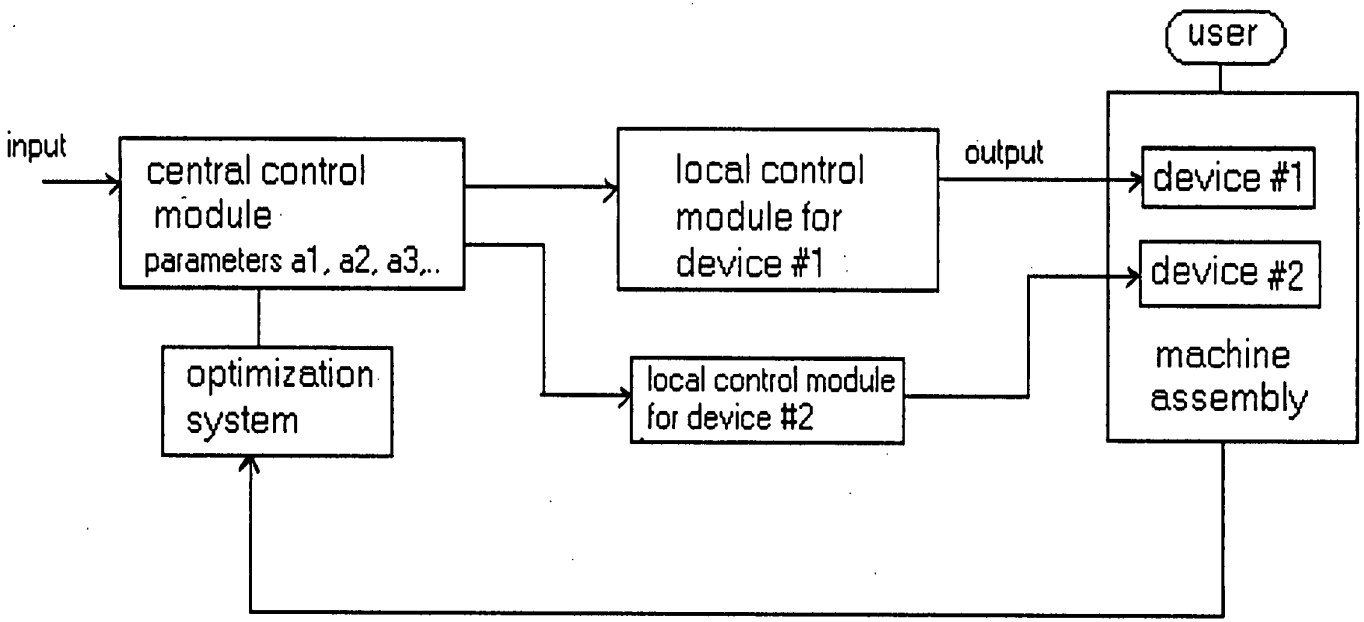
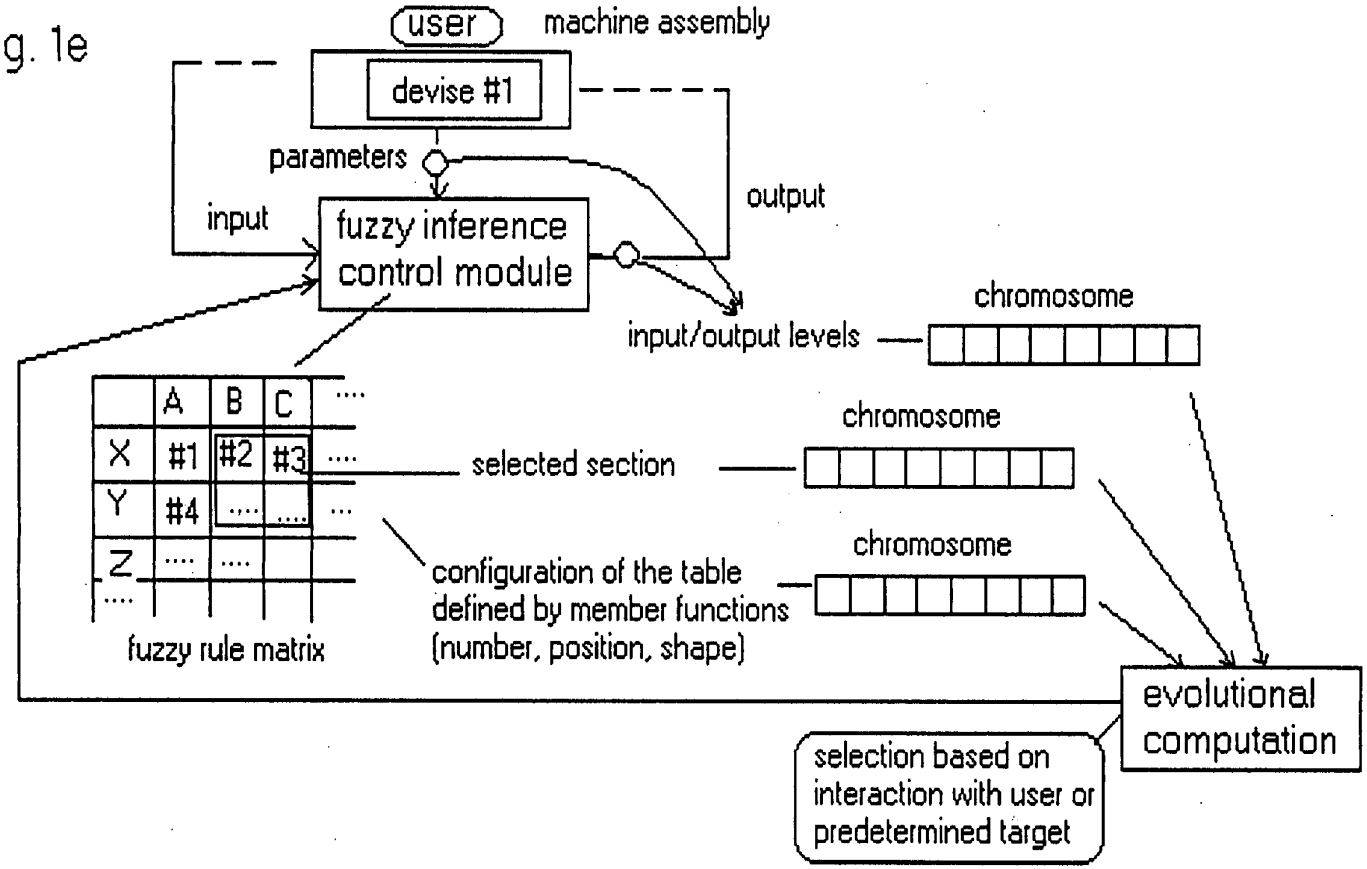

user
input
central control module
parameters a1, a2, a3,..
optimization system
local control module for device #1
output
local control module for device #2
device #1
device #2
machine assembly

Fig. 1e


user
machine assembly
devise #1
parameters
input
fuzzy inference control module
output
chromosome
input/output levels
A
B
C
X
Y
Z
#1
#2
#3
#4
selected section
chromosome
configuration of the table defined by member functions (number, position, shape)
chromosome
fuzzy rule matrix
evolutional computation
selection based on interaction with user or predetermined target

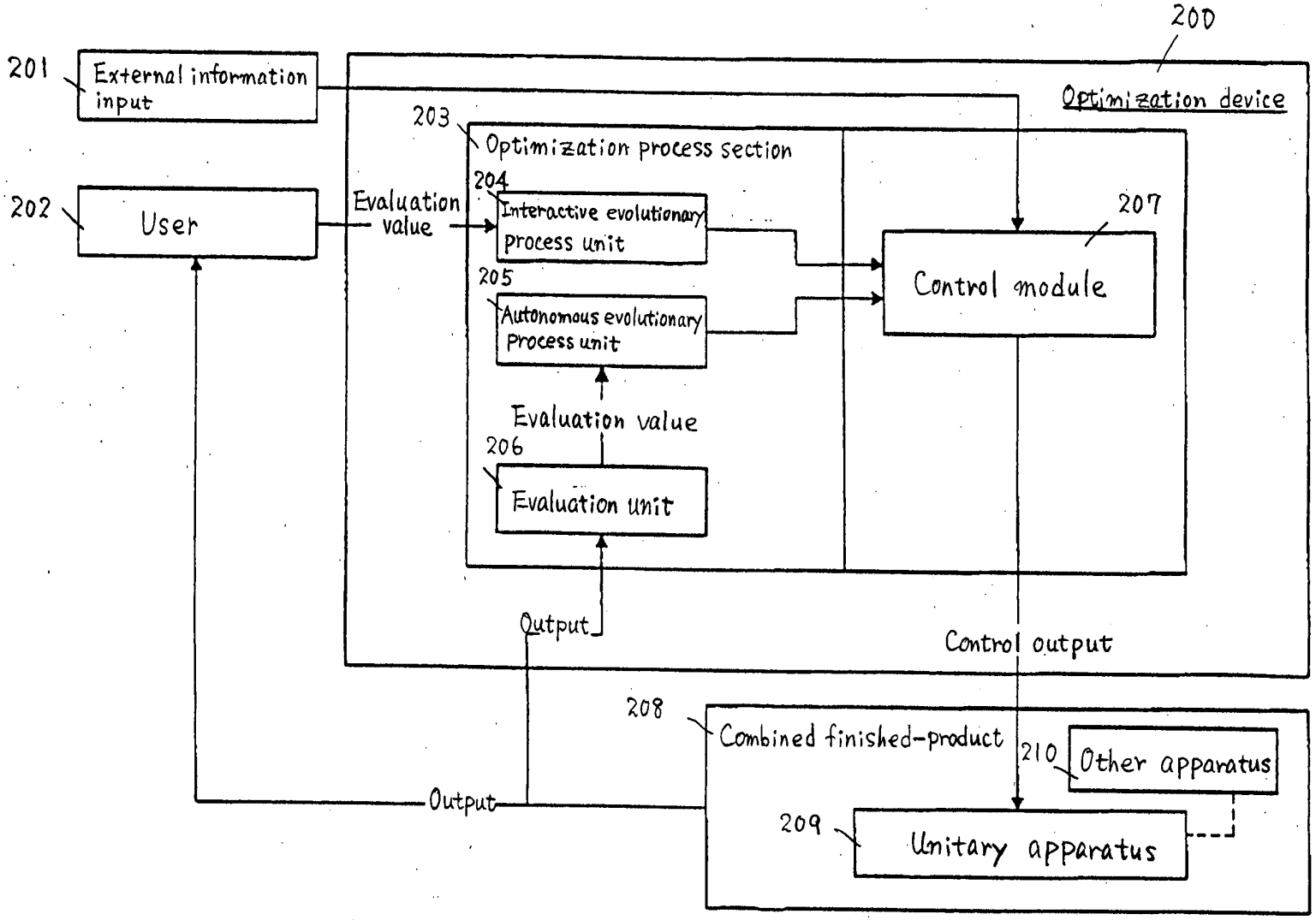

200
Optimization device
201
External information input
202
User
203
Optimization process section
204
Interactive evolutionary process unit
205
Autonomous evolutionary process unit
206
Evaluation unit
207
Control module
Evaluation value
Evaluation value
Output
Control output
208
Combined finished-product
209
Unitary apparatus
210
Other apparatus
Output

FIG. 2

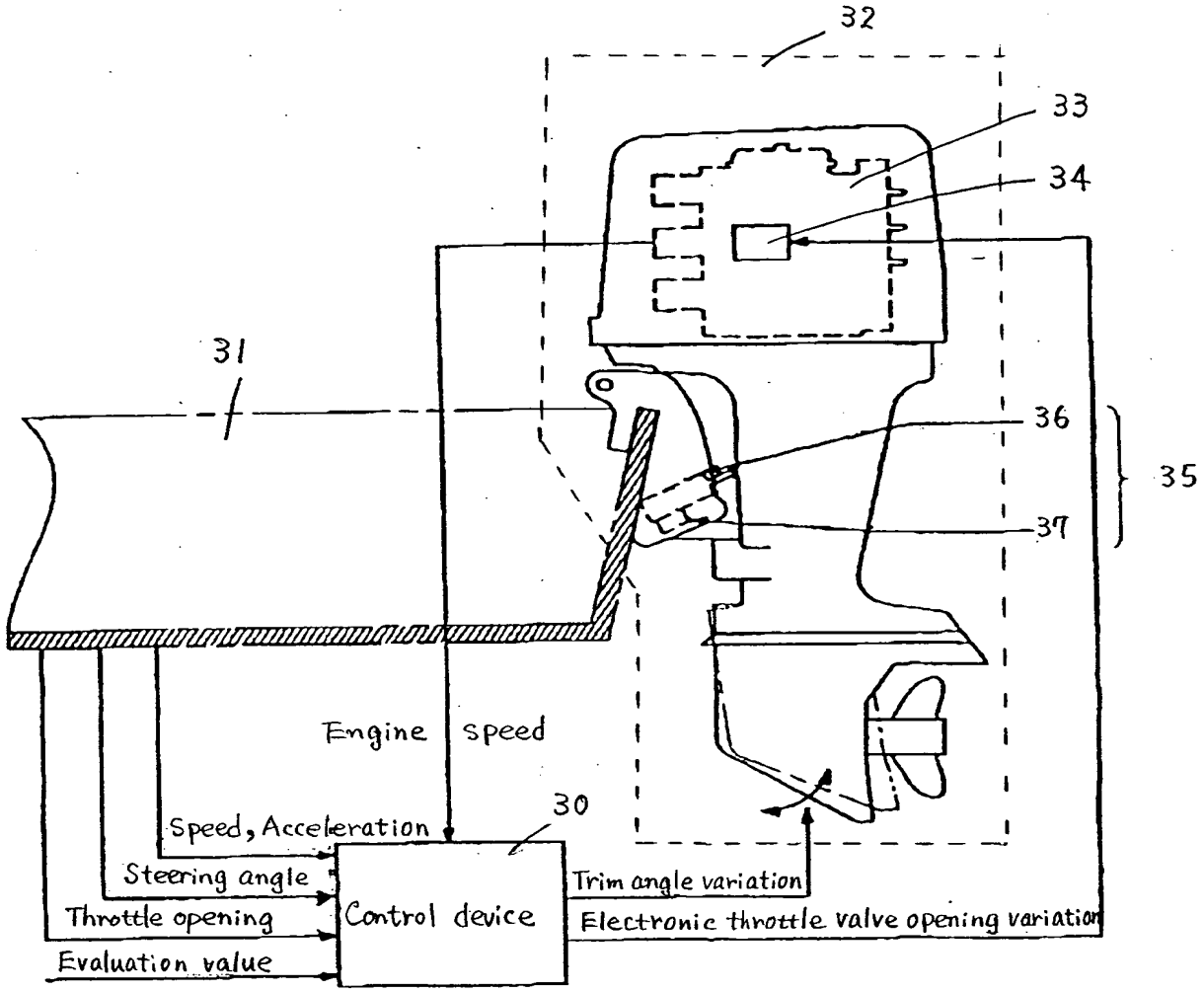

32
33
34
31
36
35
37
Engine speed
30
Speed, Acceleration
Steering angle
Throttle opening
Evaluation value
Control device
Trim angle variation
Electronic throttle valve opening variation

FIG. 3

CN 108216460 A

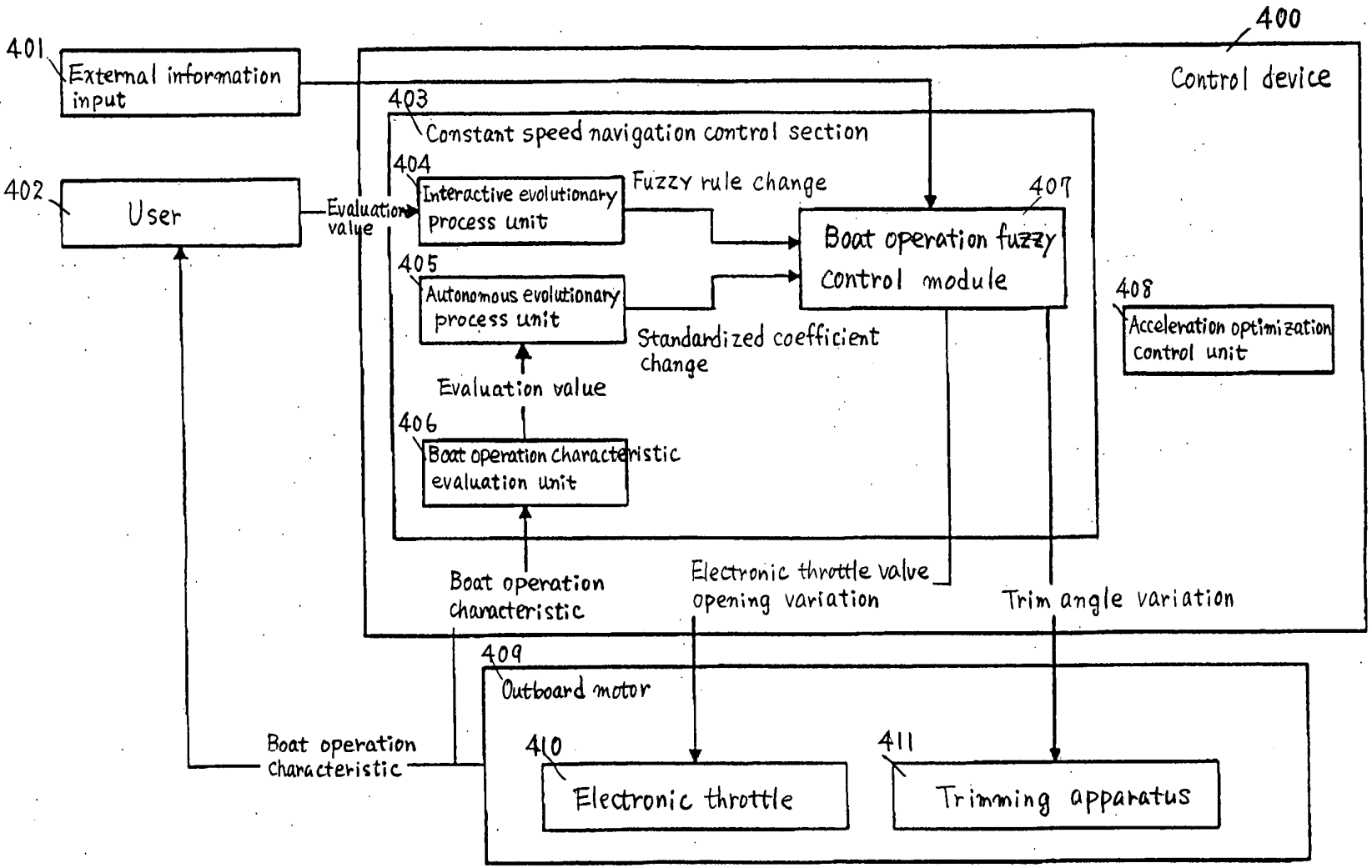


FIG. 4

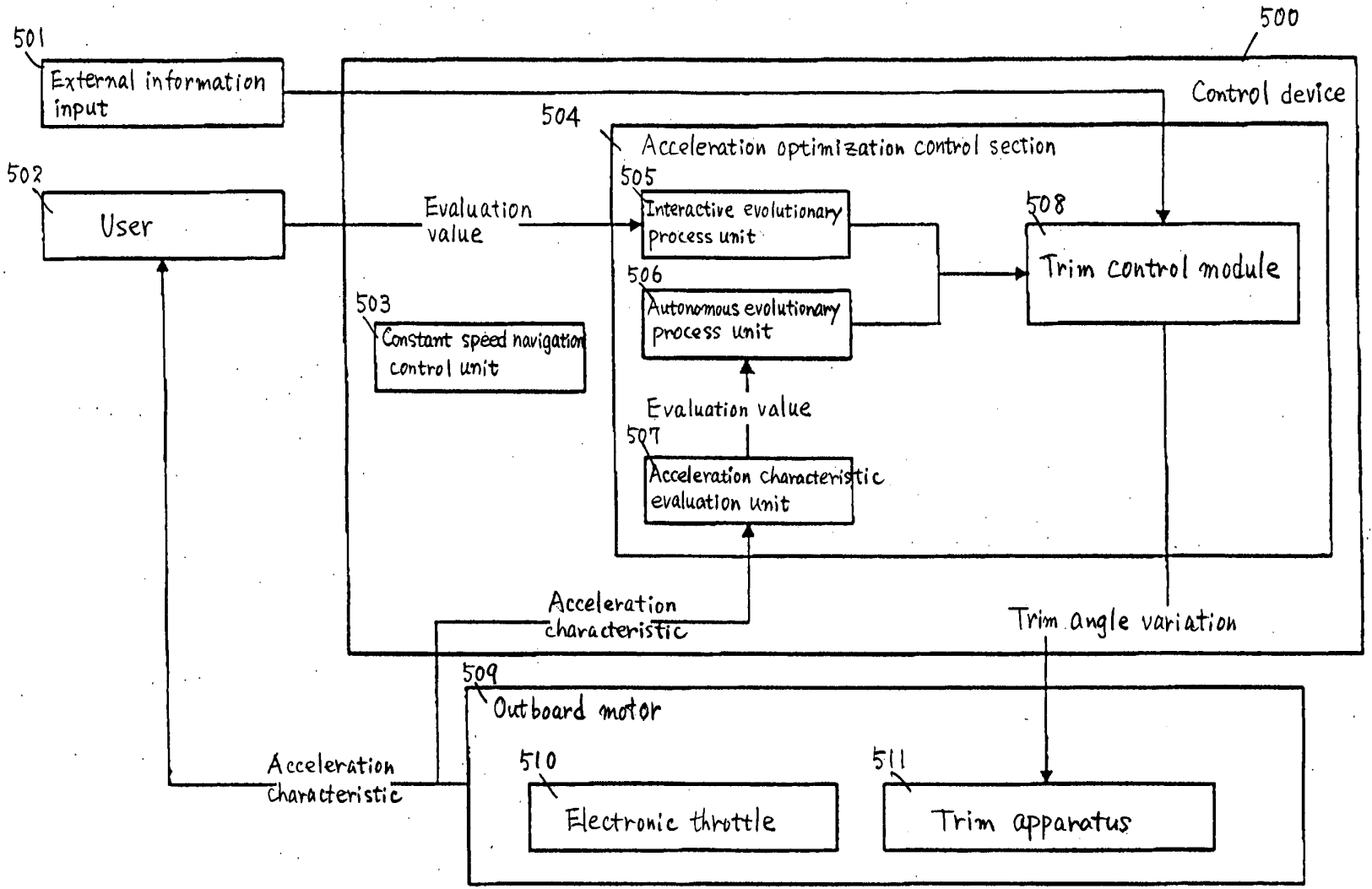
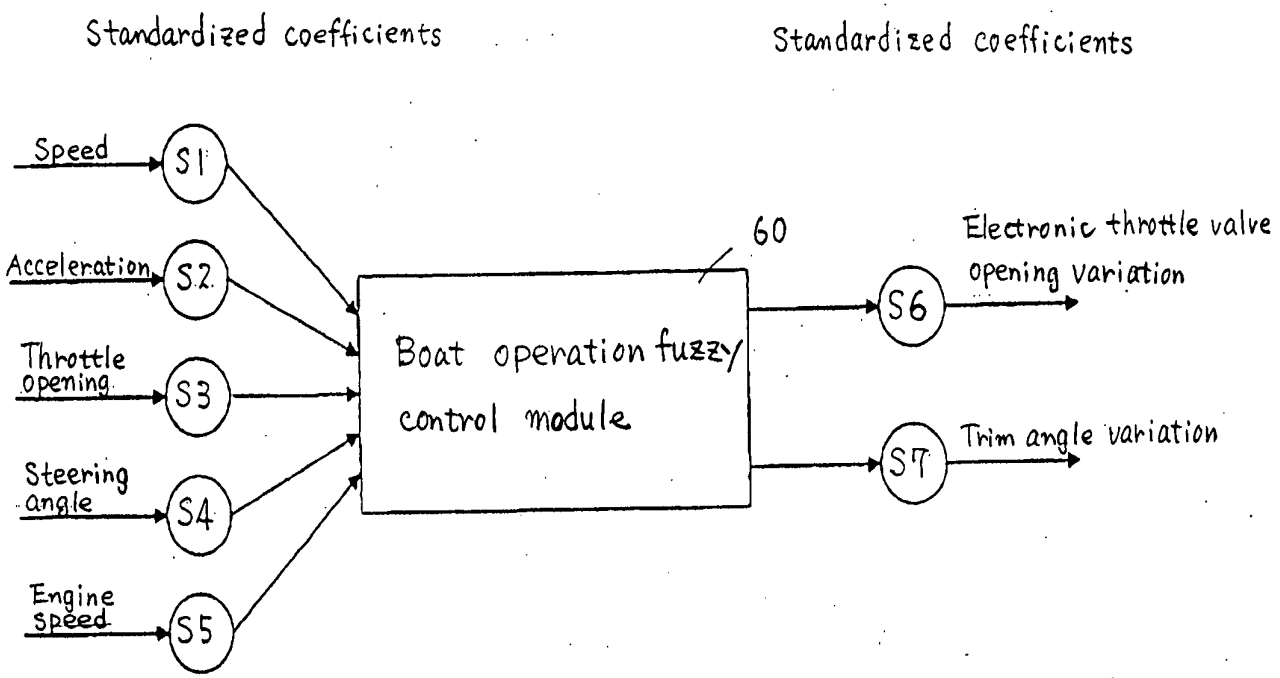

501
External information input
500
Control device
504
Acceleration optimization control section
502
User
Evaluation value
505
Interactive evolutionary process unit
508
Trim control module
506
Autonomous evolutionary process unit
503
Constant speed navigation control unit
Evaluation value
507
Acceleration characteristic evaluation unit
Acceleration characteristic
Trim angle variation
509
Outboard motor
Acceleration characteristic
510
Electronic throttle
511
Trim apparatus

FIG. 5

DOCKET NO. 2260



S1	S2	S3	S4	S5	S6	S7

FIG. 6

0010ET "H2H22260

Speed

Acceleration

	FAST	MID	SLOW
PL	−10°	−5°	−1°
PS	−5°	−1°	0°
ZR	−1°	① 0°	③ +1°
NS	0°	② +1°	④ +5°
NL	+1°	+5°	+10°

Fuzzy rule table

input: Speed, Acceleration

output: Electronic throttle valve opening variable

Extraction →

①	②	③	④
0°	+1°	+1°	+5°

Perturbation with normalized random numbers added ↓

+0.5°	+1.3°	+0.4°	+6.1°
−0.3°	+1.4°	+2.0°	+4.9°
+0.9°	+0.6°	+1.5°	+5.2°

FIG. 7

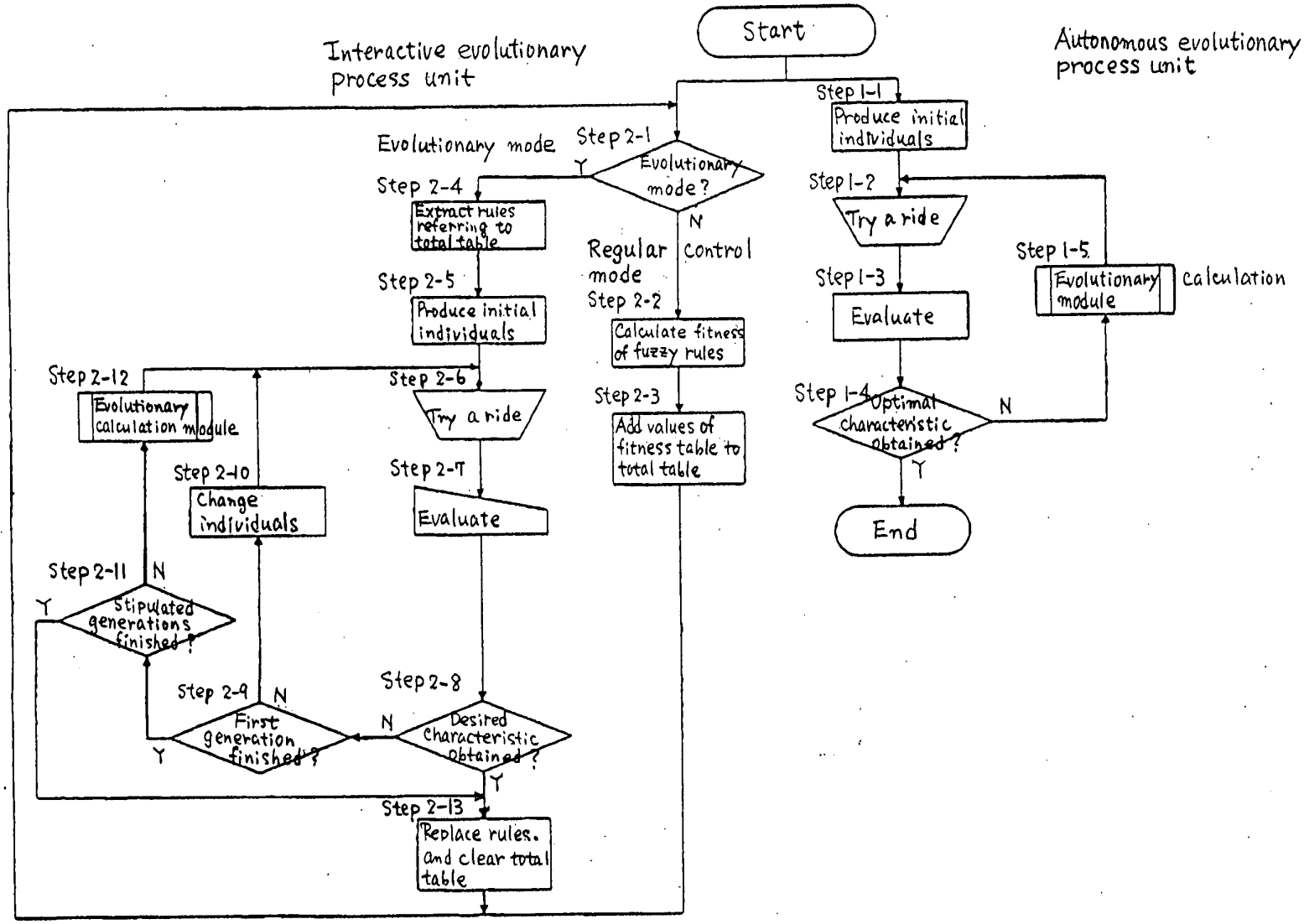

Start
Interactive evolutionary process unit
Autonomous evolutionary process unit
Step 1-1
Produce initial individuals
Step 1-2
Try a ride
Step 1-3
Evaluate
Step 1-4
Optimal characteristic obtained ?
N
Y
End
Step 1-5
Evolutionary module
calculation
Evolutionary mode
Step 2-1
Evolutionary mode ?
Y
N
Regular mode control
Step 2-2
Calculate fitness of fuzzy rules
Step 2-3
Add values of fitness table to total table
Step 2-4
Extract rules referring to total table
Step 2-5
Produce initial individuals
Step 2-6
Try a ride
Step 2-7
Evaluate
Step 2-8
Desired characteristic obtained ?
N
Y
Step 2-9
First generation finished ?
N
Y
Step 2-10
Change individuals
Step 2-11
Stipulated generations finished ?
N
Y
Step 2-12
Evolutionary calculation module
Step 2-13
Replace rules. and clear total table

FIG. 8

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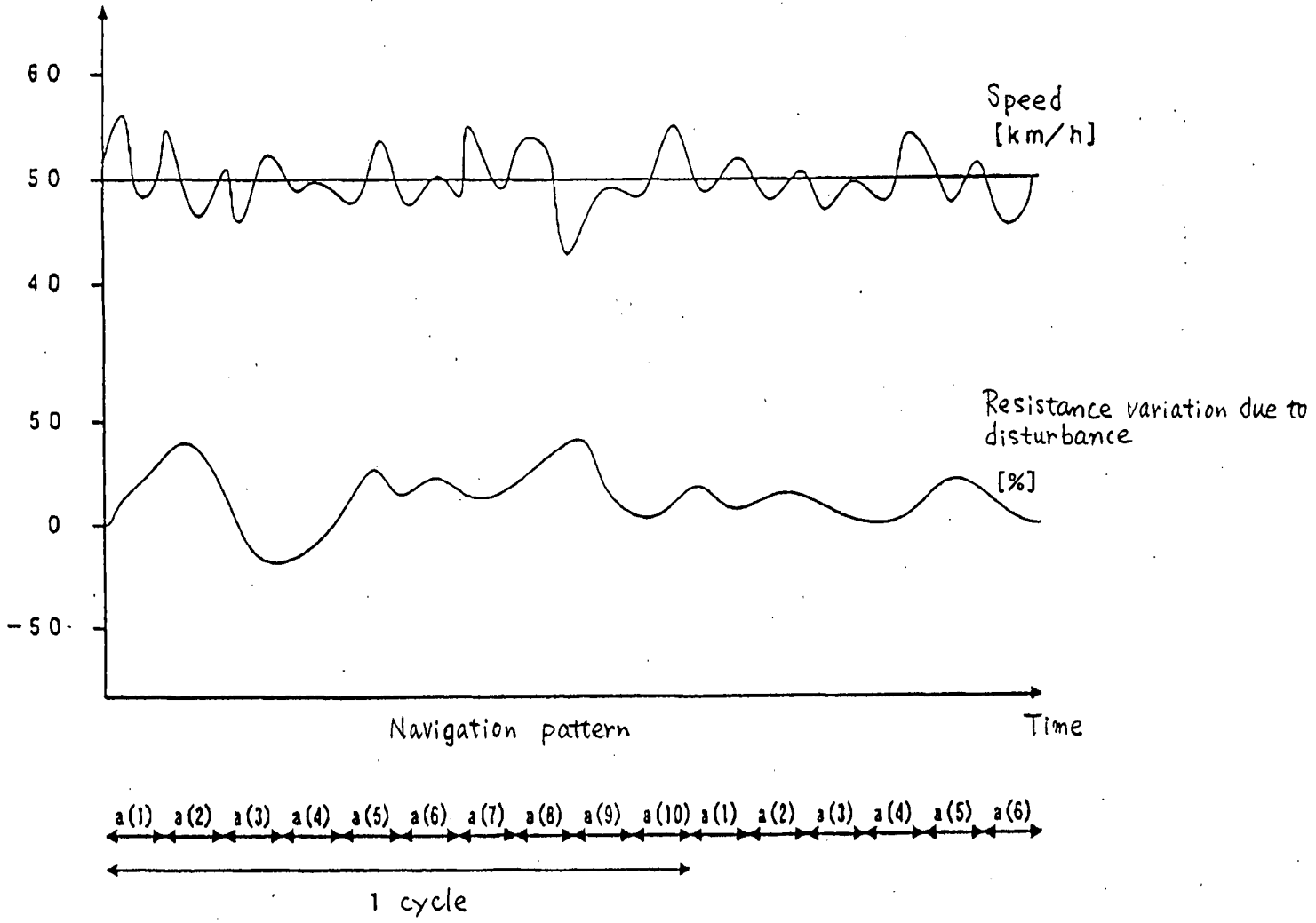

FIG. 9

0010E*h2h2260

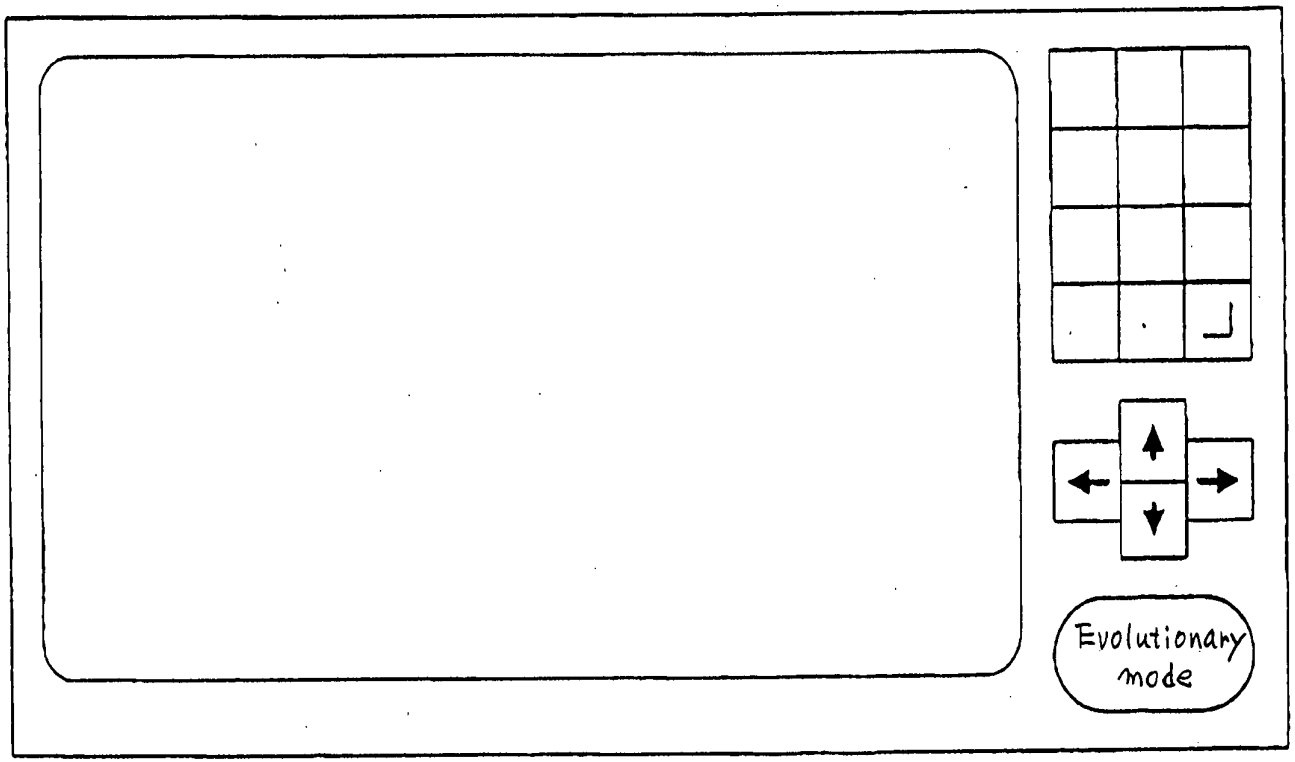

FIG. 10

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Speed

Acceleration

	FAST	MID	SLOW
PL			
PS		0. 42	0. 28
ZR		0. 18	0. 12
NS			
NL			

Fitness table

Add →

Speed

Acceleration

	FAST	MID	SLOW
PL	0. 02	1. 87	0. 27
PS	4. 96	8. 39	3. 72
ZR	12. 61	① 86. 42	③ 35. 48
NS	9. 55	② 49. 75	④ 22. 37
NL	8. 96	18. 19	2. 44

Total table

FIG. 11

Outboard Technology

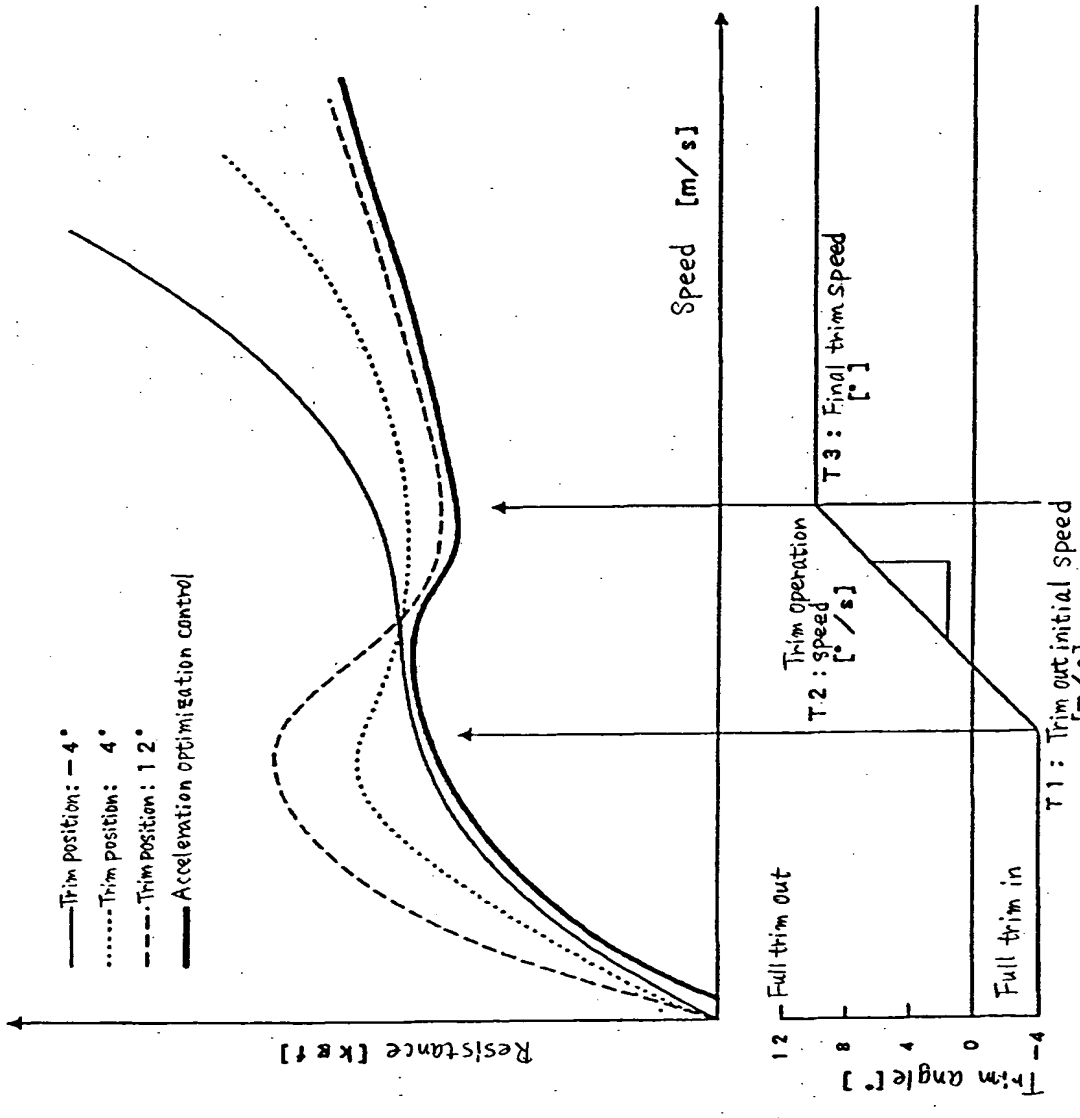

FIG. 12

T1	T2	T3

FIG. 13

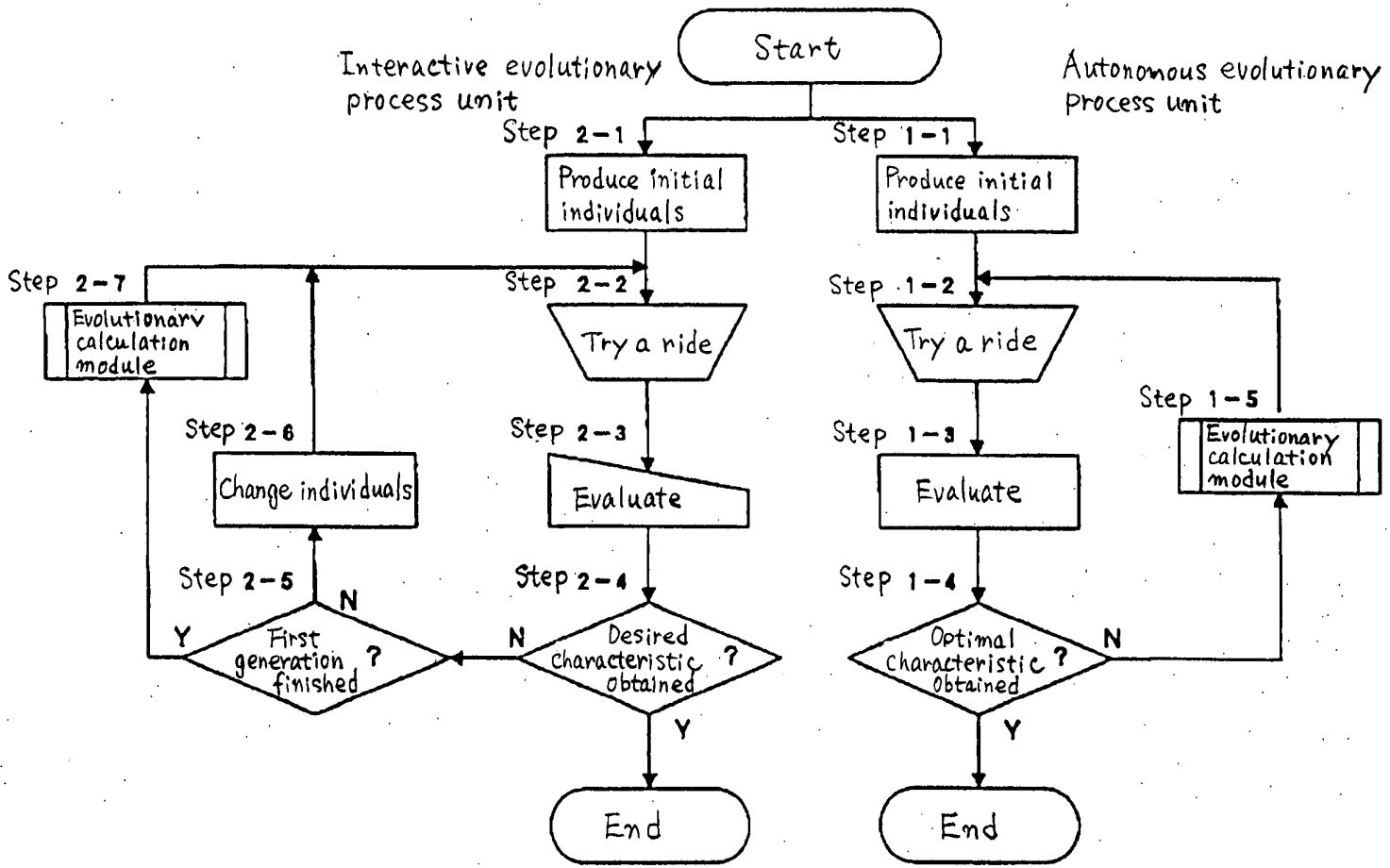
Start
Interactive evolutionary process unit
Autonomous evolutionary process unit
Step 2-1
Produce initial individuals
Step 1-1
Produce initial individuals
Step 2-7
Evolutionary calculation module
Step 2-2
Try a ride
Step 1-2
Try a ride
Step 1-5
Evolutionary calculation module
Step 2-6
Change individuals
Step 2-3
Evaluate
Step 1-3
Evaluate
Step 2-5
N
Y
First generation finished ?
Step 2-4
N
Desired characteristic obtained ?
Step 1-4
Optimal characteristic obtained ?
N
Y
Y
End
End

FIG. 14

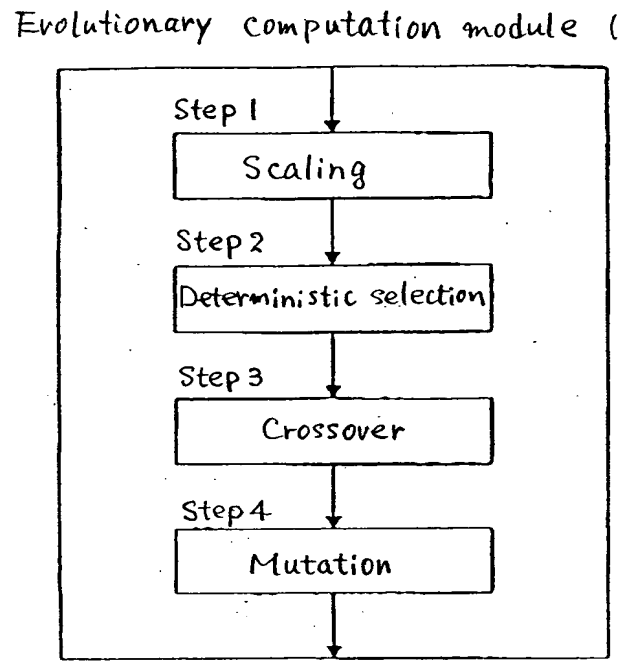
Evolutionary computation module (GA)
Step 1
Scaling
Step 2
Deterministic selection
Step 3
Crossover
Step 4
Mutation

FIG. 15

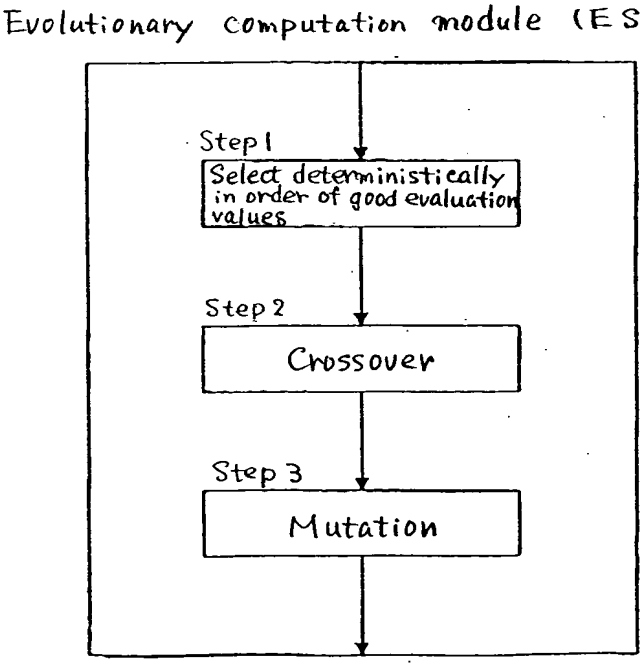
Evolutionary computation module (ES)
Step 1
Select deterministically in order of good evaluation values
Step 2
Crossover
Step 3
Mutation

FIG. 16

Evolutionary computation module (EP)

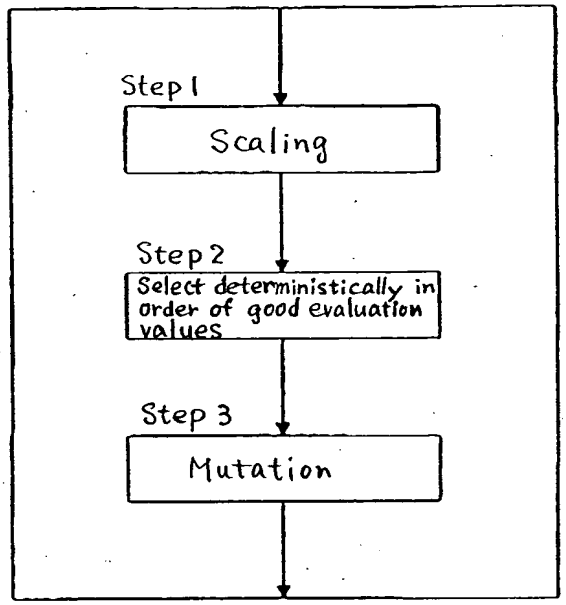

FIG. 17

0010EP 1B1 I2260

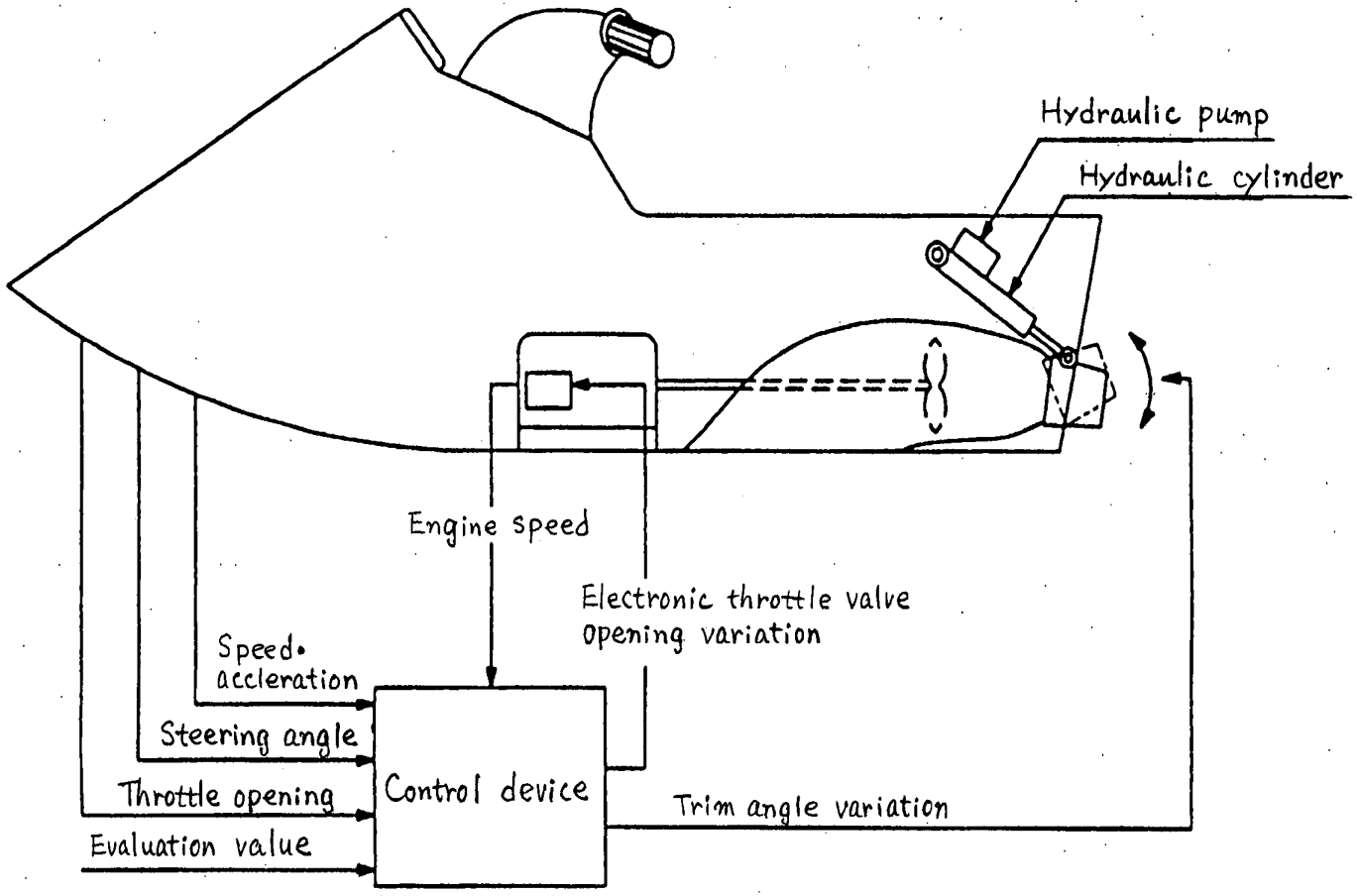

FIG. 18

06702T-tch2260

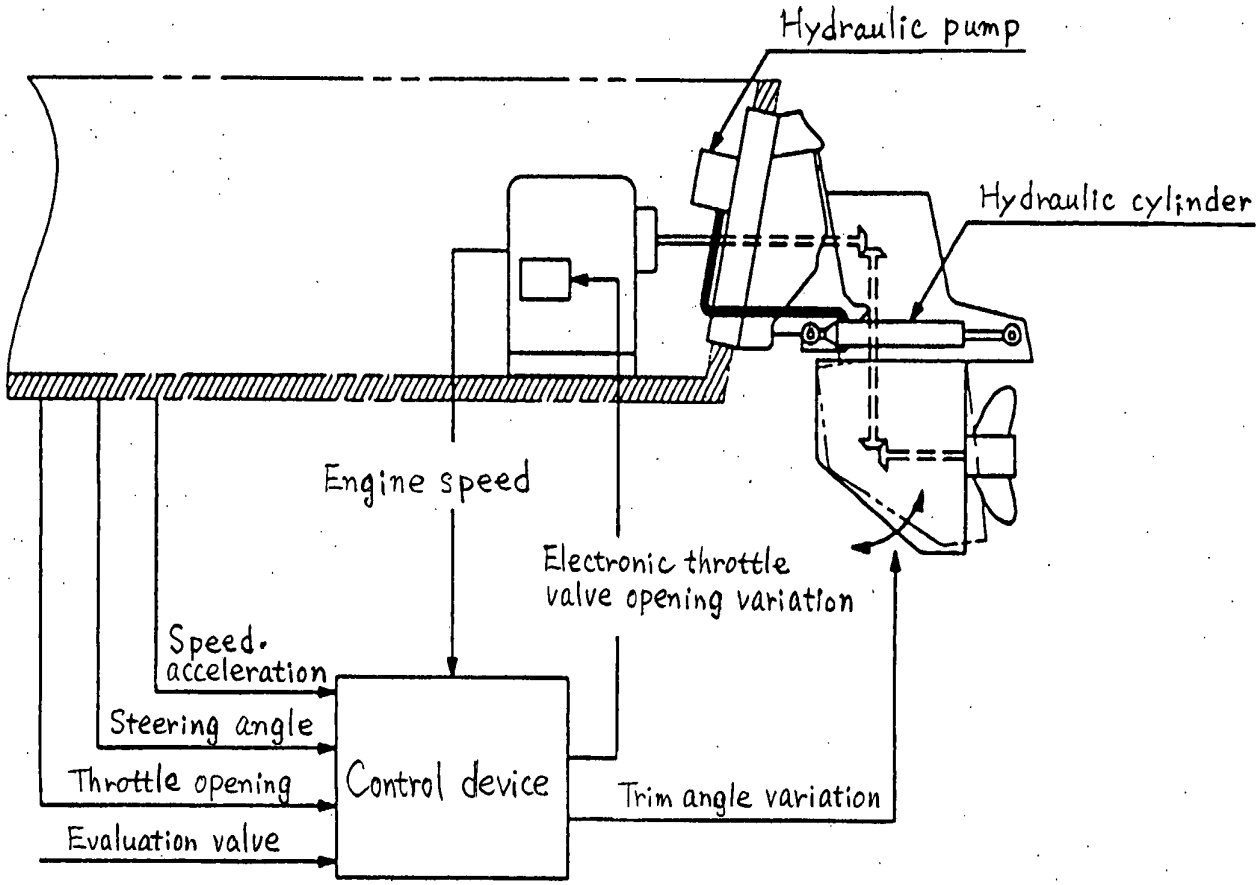

FIG. 19

0010E' ten2260

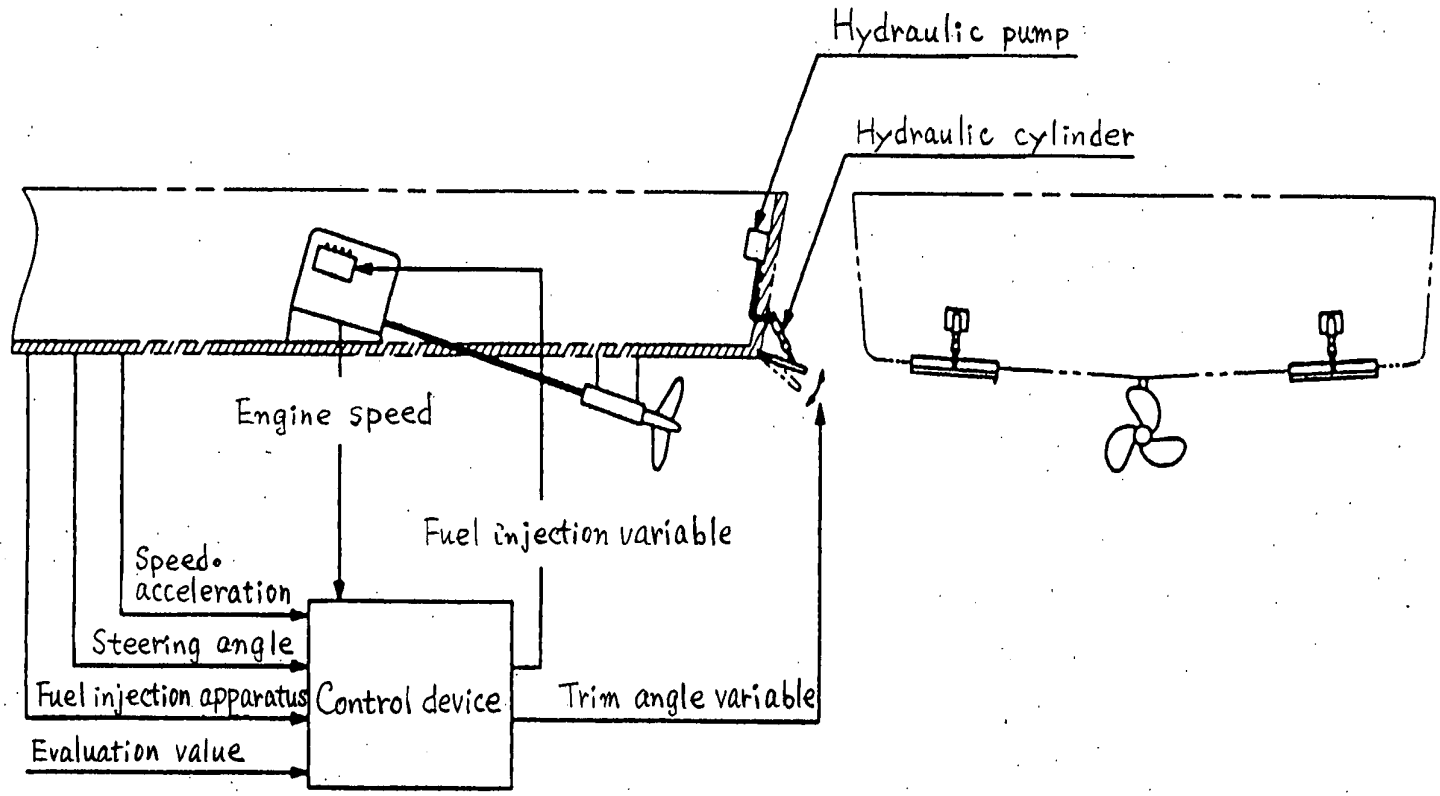

FIG. 20

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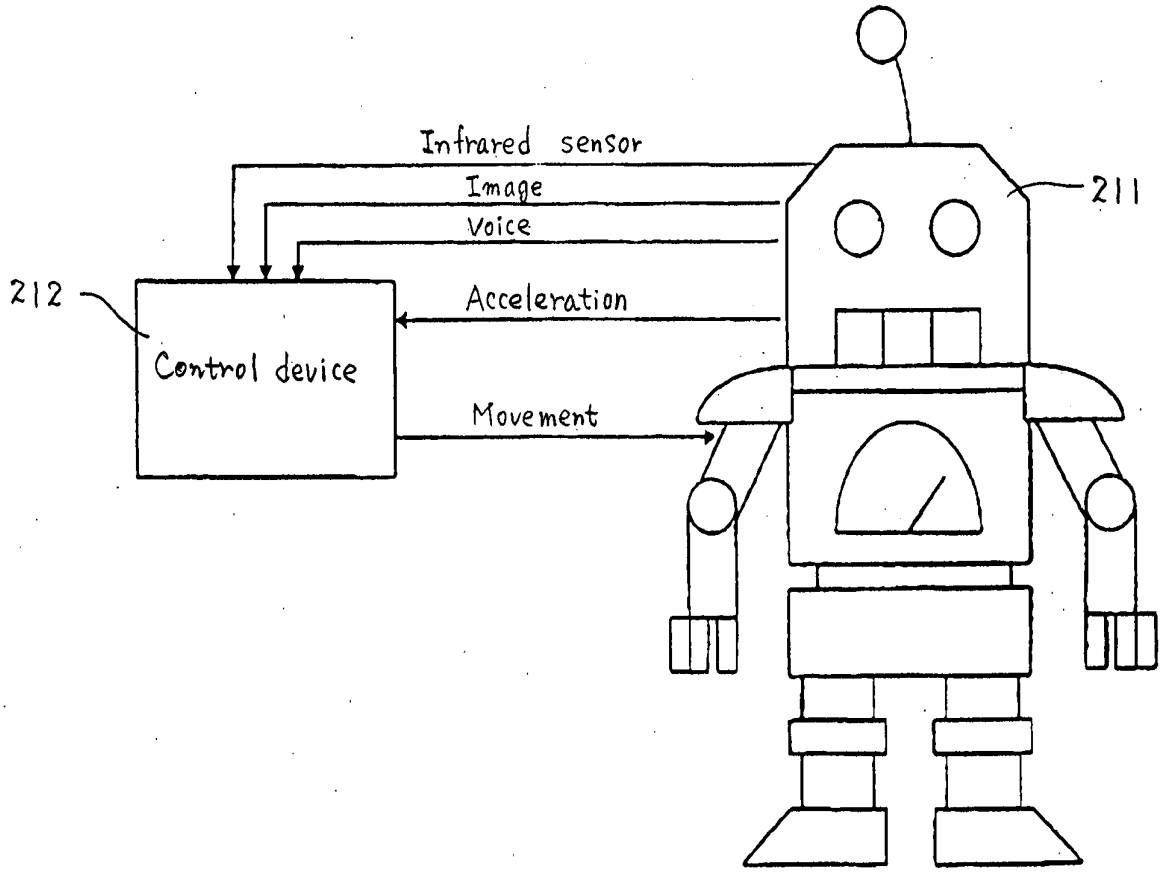

FIG. 21

0070EP "h2h2260

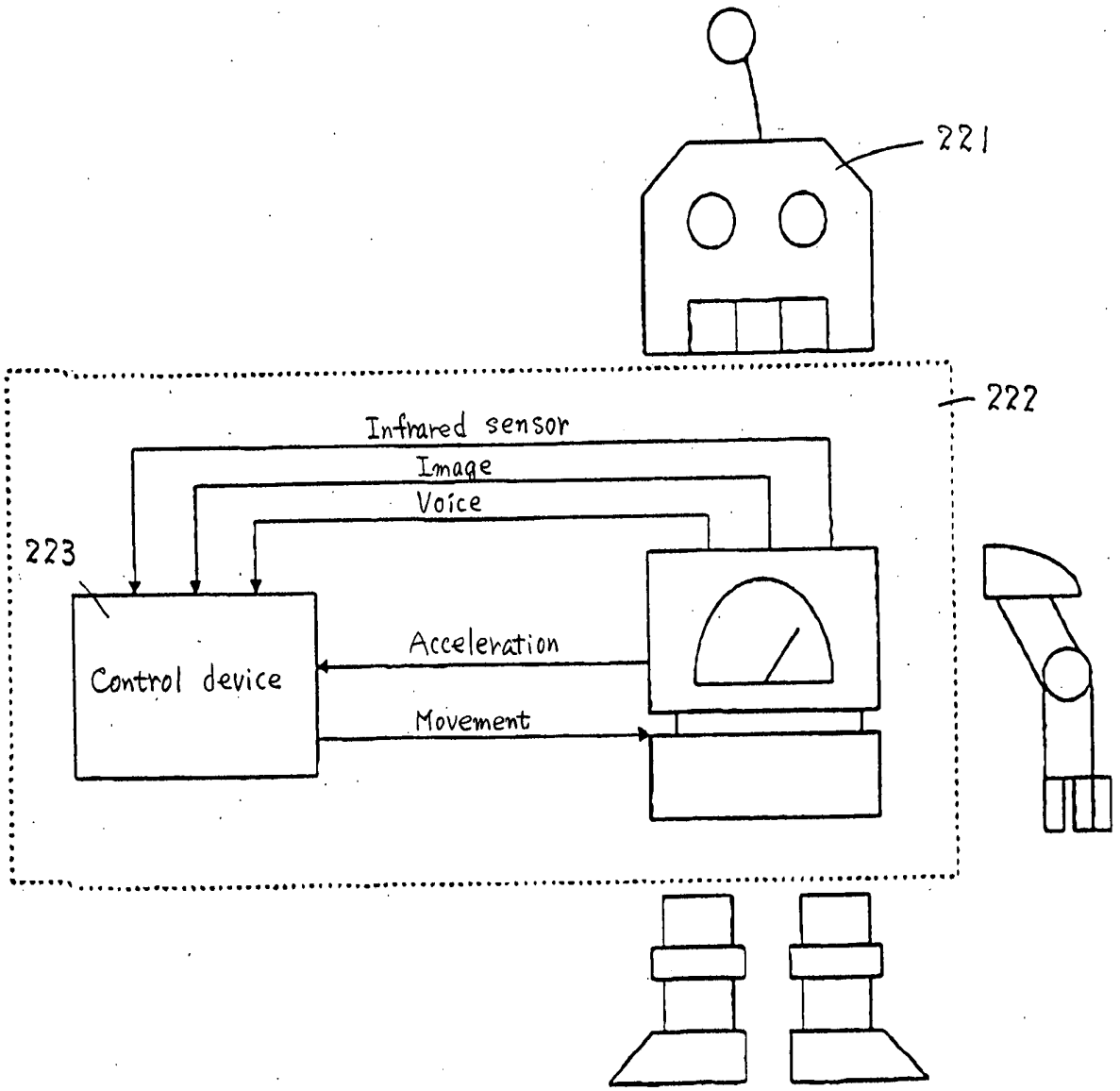

FIG. 22

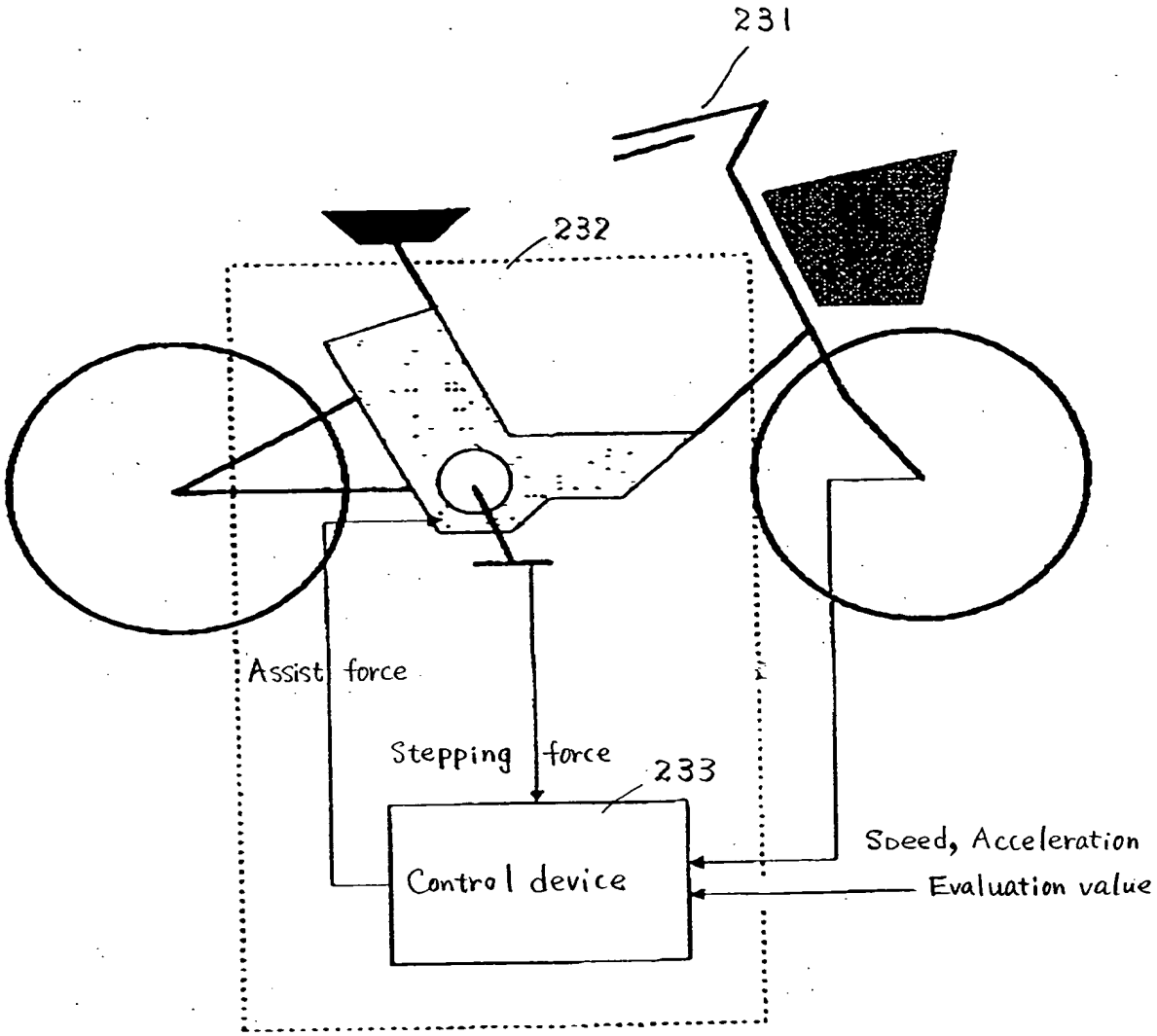
231
232
Assist force
Stepping force
233
Control device
Speed, Acceleration
Evaluation value

FIG. 23